Provincial Guide for the Submission of Timber Supply Analysis Information Packages for Tree Farm Licences

Version 3

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Timber Supply Branch

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1 Introduction

This document is the guide for preparing information packages for Tree Farm Licence (TFL) timber supply analyses. The information package documents the assumptions and modelling procedures that are used in preparing the timber supply analysis.

Following the format presented in the guide will facilitate the review by Forest Service and BC Environment staff. However, in recognition of the varied information sources and models in use in the province, it is not a requirement that the format be followed explicitly; it may be adjusted to suit the situation of each TFL. However, significant changes to the format presented here or departures from the modelling methods suggested in this document must be discussed with the Timber Supply Forester at Timber Supply Branch before proceeding.

The purpose of the Timber Supply Analysis Information Package is:

- to provide a detailed account of the factors related to timber supply that the Chief Forester must consider under the Forest Act when determining an allowable annual cut (AAC) and how these will be applied in the timber supply analysis.

- to provide a means for communication between licensee, Forest Service and BC Environment staff;

- to provide Forest Service staff with the opportunity to review data and information that will be used in the timber supply analysis before it is initiated;

- to ensure that all relevant information is accounted for in the analysis to a standard acceptable to Forest Service staff;

- to reduce the risk of having analyses rejected because input assumptions and analysis methods were not agreed upon in advance.

This document is intended to provide guidance for the preparation of information packages for TFLs. The licensee is responsible for keeping abreast of changes in forest practices on their licence and developing appropriate methods for reflecting these in their timber supply analyses even if they are not covered in the guide.

2 Process

In accordance with the TFL licence agreement, the Information Package (the package) must be submitted to the Timber Supply Forester at Timber Supply Branch (TSB) within three months after the date on which the Statement of Management Objectives, Options and Procedures (SMOOP) is accepted. The Timber Supply Forester must review the package within three months after the date on which the Timber Supply Forester receives the package.

The completed information package must be submitted as an appendix to the timber supply analysis.

2.1 Growth and yield

Licensee staff should contact Resources Inventory Branch regarding the development of Natural (unmanaged) Stand Yield Tables (NSYT) and Research Branch regarding Managed Stand Yield Tables (MSYT) prior to developing the growth and yield proposal. Items that must be discussed are: site index assignment; proposed yield table development; Operational Adjustment Factors (OAF); and Decay, Waste and Breakage (DW2B) factors. Once agreement has been reached on the procedures that will be followed, the proposal must be submitted to the Timber Supply Forester at Timber Supply Branch (this person should be identified in the pre-SMOOP assessment letter).

The growth and yield section of the package will be forwarded by the Timber Supply Forester to Resources Inventory Branch and Research Branch. The growth and yield foresters in the two branches will communicate with the licensee until all growth and yield issues are resolved. The Timber Supply Forester will advise the licensee regarding the conclusion of the growth and yield review and recommend further action if necessary. Information requirements for the review of growth and yield information are in Appendix I.

2.2 Missing data

To facilitate the review by government staff all the information documented below (that is relevant to the TFL) must be provided, including area summaries, yield tables, etc..

An explanation must be provided under each section if information is purposefully omitted.

3 Timber supply forecasts / options / sensitivity analyses

The purpose of this section is to provide a summary of the harvest forecasts that will be provided. The set of assumptions pertaining to each option and sensitivity analysis will be covered in detail in later sections.

3.1 Base case

When reviewing timber supply for a management unit, a starting timber supply forecast is needed against which timber supply implications of different management assumptions and of uncertainty in data and assumptions may be measured. This starting harvest forecast is commonly referred to as the base case. It is based on current performance and may be viewed as reflecting all requirements that would have to be met when applying for a cutting permit, using harvest systems and methods that are currently in use, and applying silvicultural management regimes that are currently used. The integrated resource and other guidelines that are in effect should be listed in the pre-SMOOP assessment letter from the Regional Manager.

3.2 Sensitivity analyses

Uncertainty around the data and assumptions used in the base case must be investigated using sensitivity analysis. Usually only one assumption is varied for each sensitivity analysis (harvest forecast). The licensee may wish to provide sensitivity analysis around other options as well.

Table 1. Sensitivity analyses

zone/ group/ analysis unit	sensitivity analysis	magnitude of change
e.g. non-conventional e.g. partial retention e.g. all	e.g. minimum harvestable age e.g. green-up age old growth	+/- 10 years +/- 2 years OG requirement +/- 5%

Where necessary, assumptions should be described in more detail.

During preparation of the analysis, more issues that warrant sensitivity analysis may become apparent. The licensee must use professional judgment to decide which additional analyses are required to provide the chief forester with sufficient information to be able to determine a reliable AAC. These analyses must also be included in the timber supply analysis report.

3.3 Alternative harvest flows over time

One of the requirements of Section 8 of the *Forest Act* is that the chief forester consider the short and long term implications to British Columbia of alternative rates of timber harvesting from the area.

Several issues must be considered in developing the base case harvest flow. For example, where harvests are declining, the rate of decline from the current harvest level should be controlled to avoid large and abrupt future harvest shortfalls and the long term level should be stable.

However, there are many possible harvest flows, with different decline rates, starting harvest levels, and potential trade-offs between short- and long-term harvests. Several alternative flow forecasts that will enable the chief forester to assess short-, medium-, and long-term trade-offs must be provided in the analysis.

In this section, describe the decision making process that will be followed in the analysis to provide appropriate and relevant alternative flow harvest forecasts.

3.4 Other options

In addition to the base case and sensitivity analyses, TFL timber supply analyses may contain options aimed at quantifying impacts on timber supply of pursuing management directions that are different than current management. The purpose of Table 2 is to summarize the issue each option is intended to analyze. Proposed sensitivity analyses around other options must also be included in this table.

The intent of the sections below is to document the assumptions that will be used in the base case. Assumptions associated with each option may be described here, or if more detail is required, under a separate heading for each option at the end of the package.

Table 2. Options

Option Title	Issue to be Tested	Proposed Sensitivity Analysis	
		Title	Range to be tested
Base Case (current performance)	e.g. To model the harvest forecast based on current management practices, performance and currently enforced guidelines	e.g. (1) Harvest age (2) regenerated stand yields (3)	e.g. To determine the impact on the harvest forecast of reducing and increasing harvest ages by 20 years. To determine the impact on the harvest forecast of reducing and increasing regenerated stand yield tables by 10%. .....
e.g. Non-Conventional (helicopter)	e.g. To test the uncertainty associated with the "non-conventional" harvest area boundary on timber supply.	e.g. (1) Reduced area (2) Increased area	e.g. To determine the impact on the harvest forecast if the non-conventional area is increased and reduced by 10%.

4 Model

Provide the following for all models that will be used in the timber supply analyses.

Model Name:

Who developed it and when?

Type:(e.g. simulation)

Description:

> The licensee is responsible for explaining to the Timber Supply Forester how the model applies all assumptions used in the analysis and for explaining results in detail if required. The licensee must provide additional analysis to verify results if these can't be explained to the satisfaction of the Timber Supply Forester.

5 Current forest cover inventory

The purpose of this section is to describe the current forest cover inventory, to document all the changes to the inventory that have taken place since the last timber supply analysis and to describe the process that was followed to obtain review and acceptance by the Forest Service. Results from the Forest Service inventory audit must also be included here along with the procedure that will be followed in the analysis to account for any discrepancies uncovered in the inventory audit.

The licensee should:

(a) Indicate if the forest inventory conforms to current Forest Service standards and explain any differences.

(b) Describe all the changes that were made to the inventory for this analysis (e.g. were any polygon labels changed? Justification for change.)

(c) Describe the review and approval process followed.

(d) Indicate the date of the original inventory and of updates/re-inventories to any or all components of the inventory (e.g. mature, immature).

(e) Indicate to which date the inventory is current (i.e. this date is usually time 0 for the harvest forecasts).

(d) Provide the definition of the age classes that are used in the analysis.

(f) Provide any other information that is necessary to provide a complete understanding of the inventory and any uncertainty associated with it.

6 Description of land base

6.1 Timber harvesting land base determination

The purpose of Table 3 is to summarize the area reductions made to the total area of the TFL to arrive at the land base that is available for timber harvesting. The reductions and additions must be listed in the order in which they are applied. Each reduction and addition must be described in more detail in the sections following.

Some of the land base and volume reductions and additions listed in the table may not apply to every TFL. Conversely, more reductions or additions could apply to some TFLs. The following table should be used as a guide in designing a table that suites the TFL being analyzed. Licensee staff must however, be prepared to explain why any of the listed items are missing in their proposal.

Table 3. Timber harvesting land base determination

	Area (ha)			Volume (m^3)		
	Schedule A	Schedule B	Total	Schedule A	Schedule B	Total
Total area (incl. fresh water)						
Non forest						
Non-productive forest						
Total productive forest						
Less:						
Inoperable/inaccessible						
NC (Non-commercial)						
Low site						
Non-merchantable						
Non-timber resources						
e.g. ESAs						
e.g. Riparian reserves						
e.g. winter range						
e.g. other						
Specific geographically defined areas						
Unclassified roads, trails and landings						
Total reductions to productive forest:						
Volume reductions (if any)						
Total reduced land base (including ???ha of NSR)						
Additions to reduced land base:						
e.g. species conversion						
Timber harvesting land base						
Less:						
future roads, trails and landings						
Long term land base						

Please include "Schedule C" lands where relevant.

Note: Boundary revisions since the last timber supply analysis must be included in the total land base. Please describe and quantify the revisions here, if applicable.

For each category in the following sections, document the total area classified as such that exists on the TFL (including overlapping categories that were deducted earlier in the land base reduction process) and

the area that is deducted in the Timber harvesting land base determination table (excluding overlapping areas that were deducted earlier in the land base reduction process).

6.2 Total area

The total area of the TFL must be documented here (including fresh water, excluding salt water).

6.3 Non-forest

Non-forest includes fresh water, snow, ice, rock, alpine, classified roads, camps, etc.

Table 4. Non-forest area

Description	Total Area (ha)
e.g. fresh water	
e.g. classified roads	
Total	

6.4 Non-productive forest

If non-productive forest has been classified in the inventory, include the area information here.

6.5 Inoperable/inaccessible

The purpose of this section is to describe the criteria that are used in defining "inoperable" areas (i.e. areas that are not available for timber harvesting because the terrain is not conducive to timber harvesting (e.g. the terrain is too steep or road access is impossible and the flight distance renders helicopter yarding uneconomic). Some licencees may have classified areas as physically inaccessible to timber harvesting and then used economic criteria to further reduce the land base to the currently physically and economically operable land base. Whatever the method used, it should be described here in detail with the appropriate reductions applied in the timber harvesting land base determination table. Classification by harvest method will be covered in more detail under section 10.3.2.

Table 5. Inoperable land base

Criteria (include detailed description below if this space is not sufficient)	Total area (ha)	Reduction area (ha)
e.g. physically inaccessible		
e.g. classified as inoperable on inventory file		
e.g. no access with current technology		
Total		

Note: Specific areas, such as inaccessible watersheds, should be excluded from the land base.

Method used to delineate inoperable/inaccessible areas:
e.g., field mapping transferred onto GIS.

6.6 NC (Non-commercial)

The purpose of Table 6 is to specify the amount of non-commercial cover (NCC) that exists on the TFL. Timber production on these areas is considered to be unlikely. They may, for example, support non-commercial brush species. If species conversion is occurring on these sites, this information should be documented in section 8.8.5.

Table 6. Non-commercial cover

Description	Total area (ha)	reduction area (ha)
e.g. NC brush		
Total		

Note: total area refers to the entire area covered by this classification including other, overlapping classifications

Note: Where relevant, describe areas with identifiable differences.

6.7 Low site

The purpose of Table 7 is to document the area that is not suitable for harvest due to its low timber growing potential (i.e. site quality).

In some cases, minimum diameter limits and/or volume per hectare limits are set in conjunction with minimum site index limits. These must be documented in Table 6.13, problem forest types.

The "area removed" reported in Table 7 should equal the low site reduction reported in Table 3.

Table 7. Low site

Leading Species	Site Index Upper Limit	Diameter at Breast Height (cm) at Upper Limit of Low Site	Volume/ha (m^3/ha) at Upper Limit of Low Site	Total Area (ha)	Area (ha) removed	Volume (m^3) Removed	Average Volume/ha (m^3/ha) Removed
Total							

Note: total area refers to the entire area covered by this classification including other, overlapping classifications

Note: "Upper" limit applies to the area that is not suitable for harvest.
For example: all areas with a site index of less than 15 are not suitable for harvest due to low site quality.

Description of process followed:

Describe the process followed in determining the low site deduction. If site index class is used, provide the range of the class.

6.8 Environmentally sensitive areas

Some forest lands are environmentally sensitive and/or significantly valuable for other resource uses. These areas are usually identified and delineated during a forest inventory and are called environmentally sensitive areas (ESAs). The ESA system uses the following categories: soil (Es), forest regeneration problems (Ep), snow avalanche (Ea), recreation (Er), wildlife (Ew), water (Eh) and fisheries (Ef). Two ESA categories are recognized: high and moderately sensitive.

In the context of timber supply analysis, ESAs may result in a reduction in harvesting opportunity on these sites. Two strategies to account for this are; percent area reductions, and the evaluation of individual ESA polygons for harvesting opportunity.

This section documents the areas that are not available for timber harvesting because they are environmentally sensitive. Table 8 will include areas that were identified as sensitive under the ESA classification system and that were not replaced using a more current and rigorous process. Examples of some more current classification systems follow this section.

Other identified non-timber resources that are not listed in this guide and for which a land base deduction most appropriately reflects management objectives must also be documented in the information package in a similar format to any of those used below.

The total operable area reduction reported here should equal the ESA reduction reported in Table 3.

Table 8. Area reductions for ESAs

ESA Category	ESA Description	Total Area	% Reduction	Area (ha) Reduction		
				Operable	Inoperable	Total
e.g. Er1						
e.g.Er2						
Total						

Note: total area refers to the entire area covered by this classification including other, overlapping classifications

Indicate if the ESA inventory conforms to current MoF standards and explain any differences:

Note: This table should not be used to approximate deferrals or management for a forest cover profile (e.g. wildlife habitat requirements). The areas excluded in this table should only be those areas that will **never** be harvested. For example, if all wildlife habitat (ESA code EW) will be harvested over time; the areas should be left in the timber harvesting land base and the harvest scheduling objectives should be modelled using forest cover requirements (see Section 10.2).

6.9 Riparian reserves and management zones - streams

If a comprehensive stream classification inventory is available for all or a portion of the TFL, the area of reserve zones must be calculated in accordance with Table 1 (page 14) of the Riparian Management Area Guidebook and excluded from the land base. The information to be used in the analysis to capture the effect on timber supply from the riparian management zone is covered in section 10.2.1.7.

Where a stream inventory has not yet been completed for the entire management unit, the area in the riparian reserve zone must be estimated. If local information is available (e.g. surveys of average stream density distribution by class or comprehensive stream inventory of watersheds that are representative of general conditions on the TFL) it may be used to estimate reserve zone areas. Please provide a detailed description of the procedures and assumptions used to compile local estimates.

If no local information is available, it may be possible to use the estimates which were compiled for the FPC impact analysis, dated February 1996.

If gullies cover sufficient area to warrant additional land base deductions (in addition to riparian reserves) the method used to identify the gullies, the management strategies and the area affected must be documented in the information package. The format should be similar to Table 9 below.

Where sufficient detail is available, location specific area deductions may be applied. With the currently available timber supply models that track forest cover on many individual areas, using more spatially explicit information may provide more reliable results.

Table 9. Riparian reserve zones - streams

Location (e.g. zone)	Riparian Class	Stream Length	Reserve Width	Reserve area	Management Zone Width	Reduction Percent

Information Source:

Description of procedure used to estimate riparian reserve areas:

6.10 Riparian reserve zones - wetlands and lakes

Wetlands and lakes should be identified in accordance with the Riparian Management Area Guidebook pages 20 to 28. Tables 2 and 3 of the guidebook must be used to determine the area within the reserve zone.

As this information is being gathered, licensees will have varying levels of information available for use in the analysis. Please provide a detailed description of the information that is available and how it was used to arrive at the land base deductions for wetland and lake reserve zones.

Table 10. Riparian reserve zones - wetlands and lakes

Location (e.g. zone)	Riparian Class	Length of outer edge	Reserve Width	Reserve area	Management Zone Width	Reduction Percent
	e.g. W1 e.g. L2					

Information Source:

Description of procedure used to estimate wetland and lake riparian reserve areas:

6.11 Wildlife habitat deductions

Management prescriptions for wildlife may include "no harvesting" areas around nesting sites or other valuable habitat for endangered species. Where specific areas have been identified, they must be accounted for in the determination of the timber harvesting land base. Where the habitat occurs over broad geographic areas, land base deductions and/or forest cover requirements may be most appropriately used to model management objectives. The source of the habitat information and the reasons for applying a land base deduction must be documented in Table 11 below. Application of forest cover requirements will be covered under section 10.2.

Table 11. Estimates for wildlife habitat no harvest areas

Identifying variables (Location descriptors)			Total area (ha)	percent deduction	Excluded area (hectares)	Wildlife species

Information source:

Description of procedure used to estimate wildlife habitat no harvest areas:

6.12 Cultural heritage resource reductions

A cultural heritage resource is an object, the site, or the location of a traditional societal practice that is of historical, cultural or archaeological significance to the province, a community , or an aboriginal people. Cultural heritage resources include archaeological sites, structural features, heritage landscape features and traditional use sites. When these are known, the areas and appropriate protection or management measures must be described below.

Table 12. Cultural heritage resources

Identifying variables (location descriptors)			Total area (ha)	Percent deduction	Excluded area (ha)	Reason for exclusion

Information source:

Description of procedure used to estimate cultural heritage resource areas:

6.13 Other sensitive site reductions

Any other areas that are identified as sensitive, for which land base deductions most appropriately reflect management objectives and that are not covered under the preceding sections, must be documented in the information package. The source of the information used, the area affected and the methods used for modelling must be discussed in the information package.

If more current information for sensitive sites that were traditionally identified as ESAs is available , the more current information should be used in the analysis along with modelling methods that properly reflect the management objectives. For example, if a terrain classification has been completed, this information should be used in place of soils ESAs.

Table 13. Other sensitive site reductions

Type	Total area (ha)	Percent reduction	Excluded area (ha)	Description
Total				

Information source:

Description of procedure used to estimate other sensitive site reductions:

6.14 Problem forest types

Problem forest types are stands which are physically operable and exceed low site criteria yet are not currently utilized or have marginal merchantability. These types are wholly or partially excluded from the timber harvesting land base. Examples are balsam, cedar and hemlock stands that contain a high proportion of decadent wood, pine stands with a very high stand density, and deciduous (hardwood) stands.

The purpose of Table 14 is to document the areas that are currently considered to be problem forest types. The land base deductions are usually described according to inventory file attributes (e.g. type group, site index breaks, age, height, stocking, minimum volume per hectare and/or minimum average stand diameter).

Table 14. Problem forest types

Zone/Group	Inventory Type group	Characteristics					
		e.g. Age	e.g. Height	e.g. Stocking	Total area (ha)	Reduction percent	Area remaining (ha)

Information source and comments:

Explain how deciduous reductions are modelled. (e.g., leading deciduous species types only or deductions to conifer/deciduous type yield tables, etc.).??

6.15 Roads, trails, and landings

The purpose of this section is to quantify the area that is, and will be, disturbed by roads, trails, and landings. These areas are expected to remain non-productive unless they are permanently deactivated (returned to their original condition). Plans for road deactivation and methods used to model this activity must be included in this section.

Deactivation plans and modelling methods:

6.15.1 Classified roads, trails, and landings

Table 15 describes areas that are currently classified as roads, trails, and landings in the inventory. Usually this area is included in the non-forest land base reduction (see section 6.3). The information presented here should include a breakdown of the area in each disturbance category (i.e. roads, trails, landings). For all road reductions the road length and the width used to estimate the area must be provided if this method was used to determine the reduction for roads. Sufficient information must be provided to allow easy review and validation of this land base reduction by Forest Service staff.

This information will assist in providing estimates for unclassified and future roads, trails and landings and in reviewing past practices on the TFL.

Table 15. Classified roads, trails, and landings

Location	Total area (ha)		
e.g. zone e.g. group	roads (ha)	trails (ha)	landings (ha)
Total			

Information source:

6.15.2 Unclassified roads, trails, and landings

The purpose of this section is to document the area that is occupied by roads, trails and landings that is not classified in the forest cover inventory. The source of the information and method used to estimate this deduction must be documented in the information package.

In some areas it may be warranted to localize the reductions to broad age classes or zones or groups. For example, large unroaded fire origin immature areas should not have road reduction percentages applied. Conversely, access to cutblocks often run through old growth areas where a land base reduction may be warranted.

Table 16. Unclassified roads, trails, and landings

Location	Total area (ha)			Deactivated area (ha)				
e.g. zone e.g. group	roads (ha)	trails (ha)	landings (ha)	roads (ha)	trails (ha)	landings (ha)	reduction percent	area deducted
Total								

Information source:

Method used to estimate area or percent reduction:

6.15.3 Future roads, trails, and landings

Table 17 includes the area of all roads, trails, and landings that will be constructed in currently undeveloped areas (mature and immature).

The reduction may be applied as a percent reduction equally against all stands that will be disturbed in the future, or as an area reduction to each analysis unit, zone, group, broad maturity class or specific area.

If there are no plans to deactivate roads and restore them to some productive capacity, stands will provide harvest volume on the first entry but not on further entries. Plans for deactivation should only be included in the base case if a road deactivation program is currently in place on the TFL. Road deactivation performance information should be provided to support the modelling assumptions.

The area contributing to the long term harvest level is net of this deduction.

Table 17. Future roads, trails, and landings

Location	Total area (ha)			Deactivated area (ha)				
e.g. zone e.g. group	roads (ha)	trails (ha)	landings (ha)	roads (ha)	trails (ha)	landings (ha)	reduction percent	area deducted
Total								

Information source:

Method used to estimate area or percent reduction:

6.16 Exclusion of specific, geographically defined areas

The purpose of this section is to document the location and total area to be excluded from the timber harvesting land base to account for any area specific exclusions that are part of current forest management. This deduction includes, for example, parks or wilderness areas designated by Order-In-Council that are not already accounted for on the inventory file.

While areas recognized in legislation or by Order-In-Council as not contributing to the timber harvesting land base may be excluded, areas which have been deferred from harvesting because they are contentious or are under study (e.g. planning deferrals, potential parks) should not be considered unavailable for timber harvesting in the base case. The ramifications of these potential land base reductions may be explored in other timber supply options.

Table 18. Exclusion of specific, geographically defined areas

Identifying variables (Location descriptors)			Excluded area (hectares)	Reason for exclusion

Information Source:

Method used to estimate area reduction:

6.17 Any other land base exclusions

The purpose of this section is to specify the location and total area to be excluded from the timber harvesting land base for any other resource concerns that are most appropriately accounted for through land base deductions. The information source and the method used to estimate the area, as well as any other information that is pertinent to modelling these assumptions, must be included in the information package.

6.18 Area additions

The purpose of this section is to document areas that are added into the operable land base immediately or at some time during the planning horizon. A common example of this is the rehabilitation of areas that were deducted in Table 3, Timber Harvesting Land Base Determination, as non-commercial cover.

Table 19. Area additions

Reason for area addition	Analysis unit	Decade (s)	Area (ha)
Total			

Information source:

Method used to estimate area addition:

7 Inventory aggregation

7.1 Management zones and multi-level objectives (groups)

This section describes the criteria and rationale used in delineating areas that are subject to unique forest cover objectives (e.g. areas with specific forest cover objectives to satisfy wildlife habitat, visual quality objectives, biological diversity requirements etc.). In most management units, specific areas may be subject to one or more (or no) overlapping forest cover objectives. The actual forest cover constraints applied are discussed under section 10.2, Forest cover requirements.

In order to approximate multi-layer objectives, the following approach was used in the Forest Service model FSSIM. The entire management unit area must be covered by one or more unique, mutually exclusive zones. Each of these zones may be subject to a maximum disturbance, a minimum older forest or no forest cover requirement. For example, these constraints are suitable for modelling visual quality objectives and wildlife habitat objectives.

In addition to the zonal level of constraints, additional levels may be applied to any or all areas of the unit. This function of the model provides complete flexibility in combining any areas on the inventory input file ("groups" in FSSIM terminology) and subjecting them to constraints such as forest cover requirements, area harvest targets and volume harvest targets. This level of constraints is suitable, for example, for modelling landscape level biodiversity requirements and harvest targets in problem forest types.

Other models used in BC will likely use a different approach with similar results. Due to the increasing amount and complexity of the information that will be generated from timber supply models, it is essential that the procedures used and the information generated is clearly documented and explained in the information package and timber supply analysis report.

Table 20. Zones and groups

Zone/ Group	name	total area	net area	Criteria used to delineate zone/group				Rationale/ Comments
zone 1	e.g. VQO partial retention			e.g. Highway corridor e.g. all polygons classified as P R VQO				e.g. mapped by ____ as per regional/provincial landscape guidelines dated June 30/92
zone 2	e.g. Deer			e.g. Fir leading	e.g. ≥age class 4			e.g. regional/habitat guidelines dated Dec. 31/91 were followed
zone 3	e.g. Normal Management			e.g. all areas not covered by other zones				e.g. normal management included 4 pass system with 15 year green-up to account for adjacency constraints
group 1	e.g. Caribou			Caribou area				e.g. instructions in letter from MoE, regional habitat biologist, dated Feb. 14, 1993, were followed
group 2	e.g. landscape unit 1			Koch creek watershed				

Note: See Section 10.2, Forest cover requirements.

Information source:

Method used to delineate zones and groups:

7.2 Analysis units

In order to reduce the complexity and volume of information used and generated in timber supply models, individual stands may be aggregated into fewer, larger, and more or less homogeneous units called analysis units. They are usually comprised of combinations of stands with similar tree species, timber growing capability (site index) and sometimes silvicultural management regimes. Yield tables representing the growth of trees on each polygon within the analysis unit are combined to represent the area weighted average growth of stands on the unit. Yield tables for currently existing and future regenerated stands are developed using this method.

In some cases it may be warranted to assign analysis units to specified age ranges for a given species/site class combination. For example, when the site index assigned to old growth stands in the inventory does not reflect the growth potential expected for thrifty stands, analysis units may be created for each of the old growth and thrifty components of the species/site range combinations.

It may also be warranted to create separate yield tables for similar analysis units in different zones in which they occur. For example, analysis unit fir good in zone A may consist of areas with an average site index that is lower than analysis unit fir good in zone B. For this reason, analysis unit fir good in zone A and analysis unit fir good in zone B are two u ue analysis units.

Please describe in detail the methods used and reasoning behind the aggregation into analysis units.

Table 21. Analysis units

Zone/ group	Analysis Unit (# and Name)	Net Area	Variable used to define Analysis Unit				Rationale used or Comments[1]
	e.g.		Species/ Type Group	Site index range	age range	etc.	
e.g. VQO partial retention	1) S/F GMP 2) Pl GM 3) Pl P		S/F	G (SI 35+)			
e.g. Wildlife	4) S/F GMP 5) Pl/ GMP 6) C/H GMP						
e.g. Caribou	7) All					entire Caribou Zone	
e.g. Normal Management	8) S GM 9) S P 10) F GM 11) F P 12 Pl GMP 13) C/H GMP						

Information Source:

Description of methods used:

7.3 Detailed land base information requirements

Please provide the Timber Supply Forester with the detailed inventory file (digital ASCII format) created after the determination of the timber harvesting land base for the base case. This file will include polygon specific information on both the area within the timber harvesting land base and the area deducted from the total land base to arrive at the timber harvesting land base. This information will enable the Timber Supply Forester to review the land base reductions applied.

For the base case provide the Timber Supply Forester with all the timber supply model input and output files (digital ASCII format).

All files must include detailed field descriptors.

Similar information to the above for other options or sensitivity analyses may be requested by the Timber Supply Forester should she/he consider it necessary to gaining a better understanding of the timber supply on the TFL.

The Timber Supply Forester may generate reports from the files provided or request summary reports from the licensee to provide Forest Service field staff with information they may need to provide effective input into the evaluation of the information package.

[1] The rationale used to define the analysis unit may be obvious based on the variables that were used to define each analysis unit. This column should contain, for example, descriptions of areas that do not fit the criteria of the analysis unit but were aggregated into the analysis unit due to the small size of the area.

8 Growth and yield

This section will be forwarded to Resources Inventory and Research Branch staff for their review and acceptance. Acceptance of the growth and yield information is a requirement and must be obtained before proceeding with the analysis.

8.1 Site index assignments

Describe the techniques and data used to assign site index to all species and age groups (i.e. young, thrifty, mature).

Table 22 Site index assignments

Species	age range	description	area (ha)
e.g. Fd e.g. Fd e.g. Fd	0-30 31-140 140 +	coast average King	

If any site index curves are not the accepted Ministry of Forests' standard, please explain the rationale for using alternate curves. Alternate curves must be accepted by Research Branch staff.

Any adjustments to old growth site index in the base case, for an option or a sensitivity analysis must be explained in detail. Adjustments to old growth site indices in the base case must be accepted by Research Branch staff. It is strongly recommended that the methods used and the magnitude of old growth site index adjustments for another option or sensitivity analysis also meet with Research Branch staff's approval.

8.2 Utilization level

The utilization level defines the maximum stump height, minimum top diameter (inside bark) and minimum diameter at breast height by species and is used in the analysis to calculate merchantable volume. The level documented here is the utilization level currently applied in operations. Please include the firmwood standard where it is not equal to 50%.

Table 23. Utilization levels

Species	Utilization			
	Minimum dbh (cm)	Maximum Stump Height (cm)	Minimum Top dib (cm)	Firmwood standard (%)

8.3 Decay, waste and breakage for unmanaged stands

Table 25 documents the decay, waste and breakage factors by species that are applied to unmanaged stand yield tables to obtain net volumes per hectare.

These factors should be derived using Ministry of Forests' procedures. If they are not standard Ministry of Forests' loss factors, please provide a detailed explanation of how they were derived.

Decay, waste and breakage factors must be approved by Resources Inventory Branch staff in conjunction with the review of the unmanaged stand yield tables prior to proceeding with the analysis. Contact Resources Inventory Branch, Growth and Yield Section, to discuss proposed methods of determining factors and information requirements for the review of proposed factors.

Table 24. Decay, waste and breakage factors for unmanaged stands

FIZ	PSYU or local	Utilization level (cm dbh)	Age range	Factor by species (%)				
			<80, 81-120, >121	F	C	H	B	→ etc.

Table 25. Sources for decay, waste and breakage factors

Factor	Species	Source

8.4 Operational adjustment factors for managed stands

In this section, describe all operational adjustment factors (OAF) that are required to be applied if the managed stand growth and yield model predicts potential yields (e.g. TIPSY). OAFs reduce potential yields to operational yields.

Please include the following information:

- the magnitude of each factor;
- the yield table to which each factor applies;
- the components that make up each factor;
- the source of the factors; and
- data to justify the magnitude of the factors (if not the accepted MoF standard).

This information must be reviewed and accepted by Research Branch staff in conjunction with the managed stand yield tables.

8.5 Volume deductions

Table 27 documents other volume reductions by species such as reductions in existing stands where they are deemed to be excessively decadent or where a species will not be harvested in mixed stands (e.g. deciduous, larch in a spruce larch stand).

Table 26. Volume deductions

e.g. Leading species e.g. Analysis unit e.g. Type group	Problem species	Volume	Percent (%)
Total			

Explain how this reduction is modelled.

8.6 Yield table development

8.6.1 Base yield tables

This section describes the methods used to develop the base yield tables, or the yield tables that represent site specific management situations. These may be aggregated to form area weighted average yield tables that represent the average growth of stands or a group of polygons (e.g. analysis units, zones, species types). Section 8.8.1, Silviculture management regimes and Appendix I contain the detailed information used to develop the yield tables.

Methods used:

8.6.2 Aggregated yield tables

This section details the methods used to aggregate the base yield tables into the yield tables that are used in the timber supply model to represent timber yield over time for each analysis unit. Aggregation may be accomplished by generating yield tables for each polygon and area weighting these to form the aggregate table. Another method used is to area weight the attributes that are used in generating yield tables and using the resulting attributes to produce the aggregated yield tables. Whichever method is chosen, it must be clearly described to facilitate the review by Forest Service staff.

Methods used:

Note: All yield tables, base and aggregated, must be included as an appendix to the final analysis report. They must also be submitted in digital form to facilitate the review of the analysis.

8.7 Yield tables for unmanaged stands

The following sections describe the source and methods used to develop yield tables for unmanaged stands. These yield tables will be reviewed and must be accepted by Resources Inventory Branch staff prior to proceeding with the analysis.

8.7.1 Existing mature timber volumes

The purpose of this section is to describe how existing mature timber volumes (old growth) are derived.

Age Class (or age): e.g. $\geq$ age 140

Description: e.g. existing mature (old growth) timber volumes are derived from the yield tables for each analysis unit.

e.g. existing mature (old growth) timber volumes are derived using area weighted inventory plot volumes for each analysis unit.

8.7.2 Yield tables for unmanaged immature stands

This section describes the methods used to develop yield tables for currently existing and future regenerated unmanaged stands. These tables may be developed differently for different age ranges, depending on the detail of information available in the inventory.

Please describe in detail the source of the information, the growth and yield model and the methods used to derive these yield tables.

Source:

Methods used:

8.7.3 Existing timber volume check

In order to verify that no errors were made in aggregation and that no significant aggregation bias exists, the total volume of the current (starting) inventory using polygon specific volumes should be compared to the total volume of the current inventory using analysis unit volumes. If an unreasonable difference is noted, the aggregation methods should be reviewed to determine the cause of the difference. This information may be useful in explaining differences in inventory volumes identified in an inventory audit.

Please describe in detail the methods used to calculate the total inventory volume using polygon specific information and analysis unit information.

Table 27. Existing timber volume check

	Method used	
	polygon specific	analysis unit
Total volume		
% difference		

8.8 Yield tables for managed stands

The following sections describe the source and methods used to develop yield tables for managed stands. These yield tables will be reviewed and must be approved by Research Branch staff prior to proceeding with the analysis.

8.8.1 Silviculture management regimes

The purpose of this section is to describe in detail how the base yield tables are developed to reflect each silvicultural management regime within an analysis unit. When reviewing the growth and yield information submitted here and in Appendix I, Research Branch growth and yield staff may attempt to recreate the proposed yield tables. Sufficient information must be included in this information package to enable them to accomplish this.

Table 29 is an example of the kind of information that is required. Note that site index assignment for each species is described in Section 8.1.

Table 28. Silviculture management regimes

Analysis Unit		Leading Species/Type Group	Base Yield Table No.	Area (ha)	Area Weighting (%)	SI	Establishment Density (stems/ha)	Natural (n) or Planted (P)	Management			Yield Table Source
Number	Name								e.g. Spacing (stems/ha @ age)			
e.g. 1	FG	F	1	20	.2	27	2000	n	750 @ 20			TIPSY
		F	2	20	.2	30	2000	n	750 @ 20			
		F	3	40	.4	33	1400	p				
		F	4	20	.2	30	1000	p				

Information source and description (e.g. growth and yield model used):

Methods used:

8.8.2 Aggregated yield tables

In this section, list the managed stand yield tables that are applied to each analysis unit (note that aggregation methods are described in section 8.6.2).

Table 29. Aggregated yield tables

zone/group	Analysis Unit	Aggregated Yield Table Number
	1	
	2	

8.8.3 Regeneration delay

Regeneration delay is the time elapsed between harvesting and the establishment of a new stand of trees. The end of the regeneration delay may be thought of as time zero for a yield table; it is the point in time when stand growth begins.

This section describes the source of the regeneration delay information included in Table 31, below.

Regeneration delay must be included in the time elapsed before the required green-up condition is attained that allows harvesting of adjacent areas. This will be covered in more detail under section 10.2, forest cover requirements.

Source of information:

Describe how the regeneration delay is applied (e.g. in the yield tables, in the timber supply model, etc.):

8.8.4 Regeneration assumptions

This section describes how analysis units are regenerated after harvesting (i.e., to which analysis unit (or yield table) is each area regenerated following harvest).

Table 30. Regeneration after harvesting

Existing/regenerated Analysis Unit	Yield Table Number	Regenerated Analysis Unit(s)	Weighting	Regeneration Delay	Yield Table Number
e.g. hemlock good	1	hemlock good	80%	5 years	101
		fir good	20%	3 years	201

Describe the modelling methods used in applying regeneration assumptions:

8.8.5 Species conversion

The purpose of Table 32 is to document how the conversion of non-merchantable or less desirable forest types (e.g., deciduous, stocking class 4 Pl, etc.) to merchantable forest types is modelled.

Table 31. Species conversion

Existing analysis unit	Total area (ha)	% to be treated	Area to be treated (ha)	Conversion schedule (ha) decade[1]						Analysis unit regenerated to	Yield table regenerated to	Site index change[2]
				1	2	3	4	5	6			

[1] Provide the area that will be converted each decade. If species conversion is modelled differently, provide a detailed explanation of the methods used.

[2] Document the site index change (if any) in converting from the existing analysis unit to the regenerated analysis unit. Provide documentation that proves that the site index change actually occurs. This information will be reviewed by Research Branch staff.

Provide an account of the history of species conversion on the tree farm licence, including area treated and rate of treatment (i.e., ha/year).

Describe in detail the methods and attributes used in generating these managed stand yield tables.

8.9 Silviculture history

8.9.1 Existing managed immature

The purpose of Table 32 is to document, for each analysis unit, the area by age class of existing managed second growth stands within the TFL.

Table 32. Immature management history

Analysis Unit		e.g., Natural (ha) Age Class			e.g. Planted (ha) Age Class			e.g. spaced (ha) Age Class			Total Area (ha)
#	Name	1	2	3	1	2	3	1	2	3	
1	FG										
2											
3											
4											
5											
6											

Note: Add further age classes if required.

Explain how these stands are accounted for in the analysis (i.e. are they grown on MSYTs? How was site index assigned?). Assumptions made in the analysis about the history of management on the TFL must be supported with evidence.

8.9.2 Backlog and current non-stocked areas (NSR)

Backlog NSR is any area that was denuded prior to 1987 (when basic silviculture became the obligation of the licencees) and is not yet fully stocked. All other NSR is current NSR.

Table 33 documents the areas in the timber harvesting land base that are backlog and current NSR and specifies how and when these areas will be regenerated.

Table 33. Backlog and current NSR

Original Analysis Unit	Analysis Unit Regenerated to	Backlog NSR		Current NSR		Total Area (ha)
		Area (ha)	Years until Stocked[1]	Area (ha)	Years until Stocked	
1						
2						
3						
4						
5						
–						
Total						

Note: If inoperable NSR exists on the TFL, please include a similar table describing this area and discuss plans for management if any.

Provide an account of the history of Current and Backlog NSR area regeneration, including area regenerated and rate of regeneration (ha/year).

Describe in detail how and when NSR is regenerated in the timber supply model.

[1] This column could alternatively be titled "Rate of restocking (ha/decade)" or "Regeneration Schedule" with the column subdivided into decades.

9 Protection

9.1 Unsalvaged losses

This table quantifies unsalvaged losses due to natural causes. It includes epidemic losses due to insects and disease, and losses due to fire and blowdown. When modelling timber supply, the unsalvaged losses estimate is usually added to the desired harvest forecast and then subtracted from the forecast upon completion of the modelling exercise.

In the past unsalvaged losses have been applied to the entire land base proportionately. While this may be the only available information, it should be noted that this information may be applied on a location specific and/or species specific basis.

Since unsalvaged losses are applied over the long term, the average loss should be derived from long term historic data. The objective is to include in the average annual estimate, events that are known to occur periodically (e.g. 50 year storm events).

Table 34. Unsalvaged losses

Location (zone, analysis unit)	Cause	Gross Losses (m^3/year)	Volume Salvaged (m^3/year)	Unsalvaged Loss (m^3/year)
	Fire			
	Insects (Epidemic)[1]			
	Disease (Epidemic)[1]			
	Windthrow			
	Other			
Total				

Describe how the unsalvaged loss figures were derived (e.g. time frame, major outbreaks included, etc.).

[1] Endemic losses are reflected in the yield tables.

10 Integrated resource management

10.1 Forest resource inventories

The purpose of this section is to document the status of all forest resource inventories. Indicate what standard was used to complete each inventory, the date of completion or update, and approvals obtained.

Table 35. Forest resource inventory status

Forest Resource Inventory	Standard	Date completed/ updated	Date approved	Approved by	Status
e.g. Landscape					
e.g. Recreation					
e.g. Range					
e.g. ESA					
e.g. Stream					
e.g. Wildlife					
Other					

Note: If more space is required to explain standards, etc., please change the format to include the information.

10.2 Forest cover requirements

Forest resource management objectives can often be expressed in terms of the maintenance of a desired forest cover structure. Where this applies, all areas subject to these objectives may eventually be harvested. For example, when stands have aged to meet and surpass a critical green-up age, adjacent stands may be harvested. Additional forest cover requirements may also be applied to ensure that a specified area is covered with stands older than a certain age.

As noted in section 7.1 in the discussion on multiple objectives, forest cover requirements may be applied at different levels. These may be compared to layers in GIS terminology. One possible layer may be landscape units, another may be wildlife areas, while another may be some other resource emphasis. In addition, they may be mutually exclusive or overlapping.

With the requirement to retain different forest characteristics across the landscape, it is important to identify if productive forest outside of the timber harvesting land base might contribute to the area needed to satisfy a forest cover requirement (i.e. **max**imum allowable disturbance or **min**imum area retention).

Forest cover requirements may be expressed as follows:

- a maximum area (or percent area)(THLB or productive) that may support stands younger than age X (or shorter than height Y).
- a minimum area (or percent area)(THLB or productive) that must support stands older than age W (or taller than height Z).

If necessary, both types of objectives may be applied at the same time to the same zone, group or analysis unit.

Some common forest resource values for which management can be expressed in terms of cover requirements are: visually sensitive areas, winter range, landscape unit objectives, and green-up of adjacent cutblocks before harvesting can take place.

In Table 36, list the management zones, groups and analysis units with the area included in the timber harvesting land base (THLB) and the area outside the THLB that contributes to the requirement. Include also the cover criteria required to meet the management objectives (critical ages or tree heights, percent or area in zone, group or analysis unit that must be older or younger than the critical age).

Table 36. Forest cover requirements

Group	Zone	Analysis Unit	THLB Area (ha)	Productive area (ha)	Cover requirement			
					Age 1 (years)	Maximum % (area) < Age 1	Age 2 (years)	Minimum % (area) > Age 2

Source of information:

Explain methods used including:

- how regeneration delays are incorporated into the green-up period,
- how the timber supply model, which in many cases operates using ten-year periods, accounts for green-up ages that are estimated to the nearest year,
- whether the timber supply model accounts for growth during the period when examining forest cover requirements,
- how overlapping constraints are modelled,
- how areas outside the timber harvesting land base are tracked in the model,
- if harvesting can occur in younger stands in a zone or group even though an old growth requirement is not satisfied,
- if old growth areas are reserved or replaced in the timber supply model.

10.2.1 Forest cover objectives - rationale

Please describe the rationale or method used to determine the percentages or areas in Table 36. If sensitivity analysis will be undertaken around any of the following, the reasoning behind the forest cover requirements to be applied should be discussed here.

10.2.1.1 Visual quality objectives

For each visual quality objective:

Describe the standard, rationale, and/or method used in determining the visually effective green-up age.

Describe the rationale/method used in determining the maximum percent/area that may be younger than the green-up age.

10.2.1.2 Recreation opportunity spectrum

Where the recreation opportunity spectrum is available to replace ESAs, describe the rationale and the methods used in modelling the objectives for the recreation resource.

10.2.1.3 Winter range

Describe the rationale/method/agreement(s)/report(s) that was used in determining the cover objective for winter range.

10.2.1.4 Forest ecosystem networks

Describe the rationale/method used in determining the forest cover objectives for forest ecosystem networks where these are established under the CODE or where they will be modelled as an option or sensitivity analysis.

10.2.1.5 Adjacent cutblock green-up

Describe the rationale/method used to determine the number of years before adjacent cutblocks may be harvested and the amount of area that may be non-green.

10.2.1.6 Landscape level biodiversity

The procedures for incorporating landscape level biodiversity in TSR are attached in Appendix III.

10.2.1.7 Reductions to reflect volume retention in cutblocks

Retention of volume within cutblocks may be required for a variety of forest resource considerations. These may include, for example, wildlife tree patches, riparian management zones or partial cutting systems. In the following subsections provide the combination of groups, zones or analysis units where retention occurs and indicate the percentage or volume retained.

Riparian management zones (RMZ)

Depending on the attributes that require protection within riparian management zones (RMZs), a variety of management practices might be applied. Thus, the method used to account for timber supply implications resulting from management practices within RMZs must conform to the management practices applied (e.g. harvest pattern). The availability of inventory information (e.g. FPC riparian management area stream classification) is also necessary to site specific application of constraints.

If detailed inventory information is not available for the entire management unit, similar methods and impact information applied in the FPC Timber Supply Analysis, dated February, 1996, may be used.

Please provide a detailed description of the information available and the management practices applied within this zone. The description might include forest inventory characteristics, harvesting pattern and merchantable volume retention. Also include details on how this constraint will be modelled. The following table is an example of the kind of information that should be included.

Table 37. Riparian management zones

					e.g.forest cover requirement		
zone	riparian class	length or perimeter	RMZ width	RMZ area	maximum disturbance	minimum retention	e.g.volume retention

Wildlife trees (WT) and tree patches (WTP)

The Biodiversity Guidebook discusses wildlife trees and/or wildlife tree patches that may be retained to provide stand structure over time. If landscape units have been designated, Table 20 (a), page 65 should be used. If landscape units have not been designated, Table 20 (b), page 65 should be used.

First, the decision must be made if these patches and trees will be retained permanently or replaced over time. If they will be retained, then they should be accounted for through a land base reduction and this should be included in section 6, above. If they will be replaced over time, a volume reduction at harvest may be more appropriate.

On the coast it is assumed that up to 75 percent, and in the interior up to 50 percent of the wildlife tree and patch requirement will be met in riparian management and other constrained areas. Note, however, that for some forest types more of the requirement may be met through other constrained areas or the management regime employed. The harvesting methods (e.g. selection, group selection), the vicinity to, and frequency of riparian retention and management zones, and other management practices and restrictions (e.g. retention VQO) may provide the necessary features without requiring further reductions to timber supply. Recognizing the overlap between these objectives and applying restrictions on a more

site specific basis will eliminate inappropriate reductions in volume or timber harvesting land base. In some forest types less of the requirement may be met in other constrained areas. Site specific application of this guideline to the TFL should be discussed with Forest Service and BC Environment staff during the preparation of this package.

Please describe and justify the method used to account for wildlife trees and patches.

According to the Biodiversity Guidebook, wildlife tree patches (group reserves) larger than 2 ha in size within a cutblock boundary can contribute to old-seral stage forest requirements at the landscape level. Where this occurs, the method used to include this area in the seral requirement must be described.

Table 38. Reductions to reflect volume retention in cutblocks

Zone/ group	Analysis Unit	area (ha)	Reason for Residual Volume	% recommended in Guidebook	% met in other constrained areas	Volume reduction (% or m^3/ha)

Information source:

Methods used: Please explain the methods used to model wildlife trees and patches.

10.2.1.8 Managing identified wildlife

This section explains how requirements for identified wildlife are accounted for in the analysis. The information provided should include the amount of area managed for the species of concern, the location or identification of the area (e.g. zone, group), and any land base reductions, volume reductions and forest cover requirements applied. This information should be presented in a table where possible.

Also required is a description of the modelling methods employed to account for the proposed management regime.

10.2.1.9 Community watersheds

This section describes the objectives and modelling assumptions to be used for community watersheds. These must be developed in accordance with the Community Watershed Guidebook (October, 1996). In developing modelling assumptions, particular attention must be given to section 6, Riparian management and section 8, Harvest scheduling and cutblock size. Where watershed assessment information is available, it must be used to develop forest cover requirements for the community watersheds. Where no better information is available, the constraint described in section 8.2.2, Equivalent clearcut limits on sub-basins may be used.

10.2.1.10 Higher level plans

The management objectives of any higher level plans that are in place must be described in this package along with the methods to be used to account for them in the timber supply analysis. Detailed information may be better described under each section of the package and identified as being part of the higher level plan. In some situations it may be better to describe the contents of the plan and the methods used to account for it in the analysis under one heading.

If the declaration of a higher level plan is imminent, or if management emphases associated with the plan are in draft form, it may be warranted to provide an option that demonstrates the timber supply implications of the imminent or draft plan. Proposed inclusion of draft higher level plan assumptions in the base case should be discussed with the Timber Supply Forester during the preparation of the information package.

10.2.1.11 Any other resource emphasis

Describe the rationale/method used in determining cover objective parameters for other resource issues (e.g. CWAPS, IWAPS, domestic watersheds e.t.c.).

10.3 Timber harvesting

10.3.1 Minimum harvestable age/ merchantability standards

The purpose of this section is to identify the minimum criteria stands in an analysis unit must meet to be eligible for harvest. Criteria may be mutually exclusive or inclusive (for example, with two criteria, requirements for one or both need to be meet). The minimum standards should reflect the range of conditions for an analysis unit as a whole. This information is used in conjunction with volume/age curves and diameter/age curves to estimate and verify minimum harvestable ages. For the option considered, the minimum merchantability standard must reflect the assumptions used in that option (e.g., sawlogs, pulplogs).

Note that these are simply minimum criteria. While harvesting may occur in stands when the minimum requirements are achieved in order to meet forest level objectives (e.g. maintaining overall harvest levels for a short period of time or avoiding large interdecadal changes in harvest levels), some stands may be not be harvested until well past "optimal" timber production ages when management of other resource values take precedence (e.g. requirements for the retention of older forest).

Statistics at culmination age are included in the table as a reference points.

Table 39. Minimum merchantability standards

Zone/ group	Analysis Unit	Minimum harvestable age (years)	Minimum Average Stand Volume (m^3/ha)	Minimum Average Stand Diameter (cm)	Culmination		
					Age (years)	Average Stand Volume (m^3/ha)	Average Stand Diameter (cm)

Discussion: (please explain how each minimum standard was determined and how they are applied).

10.3.2 Operability

The purpose of this section is to describe the assumptions that are used in determining the operable land base. These assumptions are usually based on physical and/or economic limitations in accessing stands that would otherwise be available for harvest. Note that land base reductions for low site, ESAs, deciduous, and other non-merchantable stands are not included with these assumptions. They are accounted for under Section 6.

In some cases, the operable area can be divided into areas that can be harvested with different harvest methods, usually referred to as "conventional" and "non-conventional"(the definition of conventional and non-conventional should be discussed with the Forest Service regional contact prior to completing this section and the operability mapping discussed below).

The assumptions used here must conform with the assumptions used in the operability mapping that must be completed and submitted to the designated regional coordinator and accepted by Forest Service field staff.

Include the date operability mapping was approved and the name of the Forest Service officer who approved it.

Table 40. Operability approval

Date Approved:	Approved By:

Assumptions used:

Please provide a detailed description of the assumptions and methods used in determining the operable land base. If areas are proposed for inclusion in the timber harvesting land base that were not included before, provide justification for including them this time (e.g. recent performance information).
The purpose of Table 41 is to summarize the results of the operability assessment by harvest method (e.g. skidder, highlead, long line, helicopter, feller buncher, etc.).

Table 41. Harvest methods

Zone/ group	Harvest Method	Area (ha)	Volume (m^3)
	Total Conventional		
	Total Non-conventional		
	Younger than harvest age		
	Operable land base		

Note: If second growth is being harvested, please provide the breakdown between old growth and second growth harvest by harvest method.

10.3.3 Initial harvest rate

The purpose of this section is to explain the rationale and/or method used in establishing the initial harvest rate. This must be documented for each option and sensitivity analysis within each option.

Explanation:

10.3.4 Harvest rules

The purpose of this section is to document the harvest rules that are used in modelling the harvest forecast (e.g., oldest first, maximum volume/hectare first, minimum volume loss, harvest the profile, etc.)

Table 42. Harvest rule

Harvest Rule	Description

If more detailed methods are used please describe them here.

10.3.5 Harvest profile

The purpose of this section is to document the harvest profile by species (or analysis unit or other) that is modeled. This profile may, for example, be specified in terms of minimum, maximum or actual area or volume or percent harvested by decade (please specify).

This information is used to forecast potential deficits in particular species or forest types, and to examine the impact on sustainable harvest levels of harvesting different species profiles. It may also be used in an option that targets the areas specified in a 20-year-plan for the first two decades of the planning horizon.

Criteria used to define the harvest profile:

Table 43. Harvest profile

Analysis Unit	e.g. Volume or Area Harvested by Decade[1]			
	1	2	3	4
1.				
2.				
3.				
4.				
5.				
6.				

Note: Include more decades if necessary.

10.3.6 Silvicultural systems

[1] Or volume (m^3), area (hectares) by decade.

List the silvicultural systems currently employed on the TFL with the respective silvicultural regime. Certain practices may be geographically specific, such as selection harvesting, and these will have to be examined in relation to the corresponding forest cover requirements. Riparian management or wildlife considerations should also be described if some partial cutting system is prescribed.

Table 44. Silvicultural systems

Silvicultural system	Eligible Analysis Units or Locations	% retention	# of entries	Time between entries (years)
e.g. partial cut (RMZ)	spruce types	50 %	1	80
e.g. selection	all	70 %	3	30

Information source: and comments:

Description of methods used:

e.g. growth and yield model used, method used to mimic partial harvesting

10.3.7 Harvest flow objectives

Knowledge of the underlying assumptions about harvest flow, or pattern over time, are essential to enable interpretation of timber supply analyses. Guidance in developing harvest flow objectives is taken from the current economic and social objectives of the Crown expressed by the Minister of Forests in a letter to the chief forester in 1994. He emphasized the importance of the continued availability of good forest jobs and to the long term stability of communities that rely on forests. He stated that any decreases in allowable cut at this time should be no larger than necessary to avoid compromising long-run sustainability.

Thus, an attempt should be made to attain the current AAC for as long as possible in the base case and then decline at a reasonable rate (< 10 % per decade if possible) to the long term harvest level. The long term harvest level is the highest harvest level that can be attained for the long term with a stable (flat line) total inventory.

Situations may occur where a medium term decline below the long term harvest level is warranted. In some cases modelling initial harvest levels above the current AAC may also be warranted. Licensee analysts should review several timber supply analyses for Timber Supply Areas (TSA) to gain a better understanding of harvest flow patterns currently considered by the chief forester in making AAC determinations. In addition they should contact the Timber Supply Forester at Timber Supply Branch to discuss any marked departures from the harvest flow objectives that are common in TSA analyses. Using a consistent approach across the province will reduce confusion when comparing timber supply for different units.

The purpose of this section is to describe the objectives that are used in modeling the harvest flow for each option and sensitivity analysis. (e.g. harvest at current AAC and decline at no more than 6% per decade to the long term harvest level; unconstrained; harvest at current AAC whenever possible, etc.).

Table 45. Harvest flow objectives

Harvest flow objectives for option: _____
1.
2.
3.
4.
↓

10.4 Other

Include any other information that impacts on timber supply. If this information cannot be incorporated into the modelling exercise, provide estimates of impacts on timber supply in the short and long term.

If this information is incorporated in the modelling exercise, provide the information source and discuss the modeling methods used.

11 Option assumptions

In this section please describe in detail the assumptions that are used for each option. Note that this may have been adequately covered in Table 2. Only the differences between the assumptions in the base case and the option need to be documented. Include land base information (e.g. land base reduction table) and any other relevant information that will help describe the intent of the option in a similar format to the assumptions documented for the base case.

Tree Farm Licence Information Package Guide

Appendix I

Standard Format For Yield Tables Submitted In TFL Management Plans

February, 1997

Purpose

The review of yield tables submitted in TFL management plans is time consuming. A common standard for the submission of yield table data will facilitate the review undertaken by Research and Inventory Branch staff. The following is the required format:

Standard of Submission

- Submit yield table data in DOS compatible ASCII format;
- Submit each table in a separate DOS file;
- Submit all files (i.e., tables) in the same format; and
- Use mnemonic naming conventions.

Format of Yield Table Data File

Each file shall contain two main sections; the header information and the yield information as follows (an example file is given on page 4):

1) Header Information

Describe each yield table using exactly 15 lines (blank lines are permitted). The following information is required in the header:

- Identification (e.g., Title, TFL#, MWP#);
- Site index (50 years breast height-age);
- Initial planting or establishment density (stems/hectare);
- Time and details of treatments (e.g., spacing, fertilizing, etc.);
- Merchantable specifications (dbh limit, top diameter, and stump height);
- Percentage reductions (if applicable) for decay, waste, and breakage. State if the tables are gross, or net of these reductions?
- Other netdowns (e.g. %, m^3/ha) for operational falldown (e.g. operational adjustment factors). Are tables gross or net of these reductions?

1) Header information (continued):

- Regeneration delay contributing to total age;
- Number of years to reach breast height;
- Maximum mean annual increment (year and amount).

2) Yield Information

Supporting documentation must be included indicating how the yield tables were generated including all assumptions and which site index curves were used (see section ?? of information package).

The following variables must be included in each table in the stated columns and starting on line number 16:

Column	Variable	Unit
1-5	total age	years
6-10	top height	m
11-20	total volume	m^3/ha
21-30	merchantable volume	m^3/ha
31-40	diameter	cm (specify quadratic or arithmetic mean)
41-50	mean annual increment	m^3/ha/yr

Additional variables (if applicable) can appear in the remaining columns. The following format is suggested:

Column	Variable	Unit
51-60	basal area	m^2/ha
61-70	density	stems/ha
71-80	optional additional data	

Note: Use 80 columns maximum.

Example of Standard Format

The following example outlines the standard format for yield tables submitted in TFL management plans. The first 15 lines contain header information and the remaining lines contain the yield table data. The header information can be any format, but must use 15 lines. In this example:

the first line of test after the dashed line indicates the first line of the file, and

the dashed line after the column heading is marked every 10 columns for your convenience.

1	Header line containing any of the required information					
2	Header line containing any of the required information					
3	Header line containing any of the required information					
4	Header line containing any of the required information					
5	Header line containing any of the required information					
6	Header line containing any of the required information					
7	Header line containing any of the required information					
8	Header line containing any of the required information					
9	Header line containing any of the required information					
10	Header line containing any of the required information					
11	Blank lines permitted					
12						
13	Tot	Top	Total	Merch		
14	Age	Ht.	Vol.	Vol.	Diameter	MAI Other Var.>
15	----------1----------2----------3----------4----------5----------6					
16	10	1.6	0	0	0.1	0
17	20	4.7	24	0	2.5	0
18	30	8.0	82	0	5.0	0
19	40	10.8	142	20	7.6	0.5
20	50	13.3	200	87	9.9	1.7
21	60	15.3	254	161	11.9	2.7
22	70	17.0	298	218	13.5	3.1
23	80	18.4	335	265	14.9	3.3
24	90	19.6	366	304	16.0	3.4
25	100	20.6	388	339	17.1	3.4
26	110	21.5	406	364	18.2	3.3
27	-	-	-	-	-	-
etc.	-	-	-	-	-	-

Ministry Approved Yield Table Generation Programs

TIPSY - A Table Interpolation Program for Stand Yields

Contact Shelley Grout, TIPSY Coordinator at:

British Columbia Ministry of Forests
Research Branch
Forest Productivity and Decision Support Section (FPDS)
2nd Fl., 31 Bastion Square
Victoria, B. C. V8W 3E7

Fax: 387-8197
Phone: 387-6718

Email VAXBCSC(SGROUT) for ALL-IN-ONE or PROFS users
SHELLY.GROUT@BCSYSTEMS.GOV.BCCA for others

VDYP - Variable Density Yield Projection System

Contact Rob Drummond, Supervisor, Growth and Yield Predictions at:

British Columbia Ministry of Forests
Resources Inventory Branch
722 Johnson Street
Victoria, B.C. V8W 3E7

Fax: 387-5999
Phone: 387-6043
email: rob.drummond@gems2.gov.bc.ca

Tree Farm Licence Information Package

Appendix II

Tree Farm Licence Timber Supply Analysis Report Guide

Objective

The objective of this document is to provide guidance for the preparation of timber supply analysis reports, not to provide a template that must be followed precisely. The presentation of the analysis is left to the innovation and imagination of each analyst, keeping in mind that it will be scrutinized by the public and special interest groups. The content of the analysis must include, as a minimum, the information listed in this document.

Most importantly, the analysis must provide the chief forester with the information he needs to determine the allowable annual cut for the Tree Farm Licence (TFL).

Purpose of Analysis

The purpose of analyzing any issue is to provide insight into the nature of the issue. This requires that:

the issue is described in detail;

the results of the analysis of the issue are described and discussed in detail giving reasons for the outcomes of the analysis; and,

that the main variables affecting the analysis, and how uncertainty, with the associated possible changes in these variables, affect the outcome of the analysis, are discussed.

Timber supply analysis is no exception to this generality.

Uncertainty

Most of the assumptions used in timber supply analysis are bounded by uncertainty. In order to assess the risk to timber supply of any assumption used in the base case being incorrect, sensitivity analysis must be conducted to provide a measure of potential impacts of having incorrectly estimated the information. The analysis report must describe sensitivity analysis results, providing assessments of the likelihood that the assumption is correct or over- or under-estimated.

Report Structure

The analysis report submitted to the Ministry of Forests (MoF) should contain two broad sections: 1) the written report, and 2) model input and output.

Audience

Recognizing that timber supply analysis is technical in nature and that a cross section of the public will want to read and understand the analysis, the report should be written for the non-expert, technical reader.

1) The Written Report

The written report contains 1) all the data and assumptions that are used in the analysis; 2) the results of the analysis; 3) the interpretation of the results of the analysis; and, 4) a recommended course of action supported by the results and interpretation of the analysis.

1) Data and assumptions

An outline of each assumption must be provided in the text.. More detailed discussion must be provided for data for which there is a high degree of uncertainty. The completed information package must be appended to the report.

2) Results

The results of the analysis must be presented. This should be done using text, summary tables and graphs.

3) Interpretation

Whereas the presentation of the results is factual in nature, the interpretation is intuitive and provides deeper insight into related issues and their impacts on timber supply. It explains why the timber supply picture is what it is and discusses the sensitivity of the timber supply to changing assumptions.

Note: Explanations must be provided for each harvest forecast (e.g. rationale for the initial harvest rate; reasons for declines/rises in the schedule; the relationship between the schedule and the long term harvest level; how do the modelling constraints and available inventory affect the forecast; how might constraints on the timber supply that could not be modelled affect the schedule).

4) Recommendation

Analysis should generally lead to a recommended course of action. Discussion of the recommendation must include supported by the results and interpretation of the analysis. It must also include the potential consequences of under- and or overestimating the magnitude of the more sensitive issues (i.e., due to information gaps, lack of technology, poorly understood issues etc.).

2) Model Input and Output

Model "input" and "output" must be provided to enable the timber supply analyst charged with reviewing the analysis to verify the results of the analysis.

The following information is required with the analysis report. Additional information may be requested as the review of the analysis progresses.

Required Documentation

Input

Model input files must be provided to allow the MoF analyst to verify that the input assumptions documented in the report were in fact used in modeling the harvest forecast.

MoF staff may require that the entire input file in digital form and in a specified format be submitted. This information will be used to attempt to reproduce the results presented by the licensee using the MoF model (FSSIM).

Output

The following information is required:

area and volume and age harvested per decade

Total to be appended to the report

Detail by AU to be provided in digital form

age class distribution by decade, merchantable and total, by area and volume

First and last decade (period) to be appended to the report

All decades (periods) to be provided in digital form

Average volume/ha and average diameter harvested by decade

Total to be appended to the report

Detail by AU to be provided in digital form

Silviculture program by decade and AU (area treated by treatment type including cost)

Total to be included in the report

By AU to be supplied in digital form

Periodic growth by decade

Long Run Sustained Yield

Define and explain how it was calculated.

Long Term Even Flow Harvest Rate

Explain how it was determined.

MSY

Define and explain how it was calculated.

Tree Farm Licence Information Package

Appendix III

Incorporating Biodiversity and Landscape Units in the Timber Supply Review

BRITISH COLUMBIA **Ministry of Forests** Timber Supply Branch **MEMORANDUM**

January 5, 2006

To: TSR Timber Supply Analysts
TSR Committee

Re: Incorporating Biodiversity and Landscape Units in the Timber Supply Review

The intent of this memo is to specify the procedures for incorporating biodiversity and landscape units into timber supply analysis for the Timber Supply Review.

A joint letter from the Deputy Minister of Forests and the Deputy Minister of Environment, Lands and Parks, "Achieving Acceptable Biodiversity Timber Impacts" was released August, 25, 1997. The deputies' letter specified the process for incorporation of biodiversity into operational planning and the landscape unit planning process. Biodiversity considerations are now a part of forest management and it is important that we determine how best to account for this in the Timber Supply Review (TSR). The procedures attached to this memo are designed to specify how biodiversity management and landscape units will be incorporated into timber supply analysis for TSR. The TSR procedures were developed at provincial timber supply analysts meetings in July and November.

TSR is not a forest management planning process and we do not have the resources to carry-out options analysis for forest management planning. Rather, TSR provides analysis for the chief forester to determine allowable annual cuts. The recurring nature of TSR, as required by the *Forest Act*, provides the means to update and revise AACs as forest management changes. Land and Resource Management Planning, Regional Land Use planning and other planning processes are appropriate vehicles for forest planning and investigation of management options.

For TSR, it is important that we produce the analysis in a timely manner, thus the need for some basic rules for incorporating biodiversity and landscape units in timber supply modeling, and, that we provide the Chief Forester with the relevant information needed to make informed and legally defensible AAC decisions.

If you have any questions about the procedures, please contact Cassandra Mann, Manager Analysis Section at 356-5953 or e-mail, Cassandra.Mann@gems7.gov.bc.ca.

Gary Townsend
Director
Timber Supply Branch
Attachment: *Timber Supply Review Base Case Modelling Assumptions for Biodiversity and Landscape Units*

Timber Supply Review Base Case Modeling Assumptions for Biodiversity and Landscape Units

Seral Stage Constraints

The following table outlines how the seral stage constraints from the FPC Biodiversity Guidebook (BGB) will be applied in the TSR.

	early seral stage	mature plus old seral stage	old seral stage
NDT 1&2			
base case	off	off [1]	on
sensitivity	turn on and just show results	turn on and just show results	
NDT 3&4			
base case	off	off [1]	on
sensitivity	turn on and just show results	turn on and just show results	

1: In the Nelson Region the mature plus old seral constraint will be applied (on) as timber supply analysis has been completed for that region that shows this constraint can be applied and still meet the targets set out in the Kootenay-Boundary Land Use Plan.

In the above table, *off* means do not apply the constraint in the base case, *on* means apply the constraint. For the sensitivity analysis the intent is to turn the constraint on/off as appropriate and just simply show what happens to the base case harvest forecast. Do not try to smooth out the flow. By simply showing what happens we will be informing the district and MELP staff when the timber supply impacts occur and the severity of the impact from the application of these constraints. The goal is to inform the district if there is an issue in the short-term or maybe this is a longer-term issue and some planning can be done to prevent the impact from occurring. This should help the district staff determine a course of action at the operational level. For example, if the mature plus old is not constraining in the sensitivity, this would provide information to district and MELP staff that there is no overall timber supply impact for the TSA or TFL, and application of the mature plus old seral constraint can proceed in forest development planning.

The table shows the mature plus old as not being applied in NDT 3 and 4. The deputies' letter calls for application of this seral stage constraint in forest development planning if there is no timber supply impact (non-constraining). The definition of non-constraining is "no impact on projected harvest flows over the entire period of the timber supply analysis, over the Timber Supply Area or TFL". From a timber supply modeling perspective this means there will be no difference between a harvest forecast with the constraint turned on and a harvest forecast with the constraint turned off. Based on the analyses of the last TSR, there are not likely to be any management units in which no impact will occur over the next 250 years when the constraint is turned on. Based on this, we will not apply the mature plus old constraint in the base case. As noted above the sensitivity analysis will, however, provide information regarding the operational application of these constraints for district staff.

Low level emphasis and the old seral stage constraints

As per the BGB and the deputies letter, it is possible to initially set the old seral stage constraint to one third of the guidebook value. This reduced constraint should be used whenever applying the full old seral stage constraint will be constraining on timber supply. Constraining on timber supply is defined the same as for application of the mature plus old constraint i.e. "no impact on projected harvest flows over the entire period of the timber supply analysis, over the Timber Supply Area or TFL". Thus, the timber supply picture is to be the same whether the constraint is applied fully or not. Since the result is to be the same, we will initially set the old seral stage requirements to one third of that in the BDG. However, it is required that over the next three rotations this be built back up to the full BDG value. Rotation was defined as 70 years in the FPC timber supply impacts analysis. Thus in order to meet the goal of applying the full guidebook value by 210 years from now the following procedure will be used.

implement constraint at time	old seral cover percent in low emphasis units
0	guidebook * 0.33
70 years	guidebook * 0.67
140 years	guidebook * 1.00

Sensitivity analysis which simply shows the resulting timber supply forecast if the full BDG values are applied at all times will be completed. Once again this will provide district and MELP staff information regarding the actual impact, if any, from utilizing the full constraint.

Landscape units

Boundaries

In order to ensure that the seral stage constraints are applied across the management unit, the draft landscape unit boundaries, if available in digital format, will be used for modeling purposes. This does not imply the landscape units are finalized; the draft units are simply a convenient modeling tool.

The draft boundaries cannot be used as final because the *Forest Practices Code Act of British Columbia* clearly lays out the formal legal process required to set both landscape unit boundaries and objectives. An analogy is protected area's designation. The Chief Forester cannot legally consider a reduced land base from a newly designated protected area as the boundaries are not yet final and the park has not yet been legally declared. When the final boundaries are established by an Order-In-Council, the land no longer contributes to the AAC. Similarly, once landscape units are formally established they will be fully considered in the TSR process.

Emphasis

The base case will not model actual emphasis assignment unless the emphasis is legally established. In other words, unless all the steps as required in the *Forest Practices Code of British Columbia Act* Part 2 section 4 and the *Strategic Planning Regulation* sections 4(1) through 6(4) and chapter 5 of the Higher Level Plans: Policy and Procedures manual have been completed.

Draft emphasis assignments will not be included in the base case for two reasons. First, as these assignments are draft and are to be finalized through the formal process noted above, they may change. If an AAC is determined on the basis of draft units, we could end up changing an AAC that did not require changing. It is important to remember that for Timber Supply Areas it is not possible to "return" wood to a licensee that has had their licence AAC reduced as a result of a Section 8 AAC determination.

The second reason is a legal issue. When a process and decision is placed in law, i.e. in an Act or Regulations, it cannot be considered a final and legally binding decision until the process is completed and the statutory decision maker(s) has formally declared the decision. Further, when a decision process is legally defined, such as the selection of landscape unit boundaries and objectives, no one can pre-judge or pre-empt that decision. Lastly, a statutory process and decision must not be fettered.

The Chief Forester is not in a position to formally account for draft landscape unit boundaries or emphasis until legally defined. However, as the landscape unit planning process is scheduled to be completed in the next few years it is important that we do not ignore the fact that landscape units may have an impact on timber supply. Thus, the following method will be used in the TSR. This method incorporates some impacts from having high, intermediate and low emphasis while at the same time not actually assigning each landscape unit its own emphasis. Instead, each individual draft landscape unit will have a weighted constraint applied to it.

The seral stage constraints from the BDG will be weighted based on the target proportions of 10/45/45, high, intermediate and low. The following example includes the reduction to one third of the old seral stage constraint, as explained above.

Example NDT 2: CWH: (Low= 9%; Intermediate = 9%; High = 13%)
calculate the percent old growth requirement to be applied to each unit as follows:

Time 0	13%*0.10	= 1.30	
	9% * 0.45	= 4.05	
	(9%*0.33)*0.45		= 1.34
		6.7%	
Time 70	13%*0.10	= 1.30	
	9% * 0.45	= 4.05	
	(9%*0.66)*0.45		= 2.67
		8.0%	
Time 140	13%*0.10	= 1.30	
	9% * 0.45	= 4.05	
	9% * 0.45	= 4.05	
		9.4%	

If there are draft emphasis assignments available, a sensitivity analysis will be run using these draft emphasis. This will allow an assessment of whether the area weighting procedure is reasonable for the management unit being analyzed. In addition, if landscape unit planning is occurring in a management unit that is being analyzed for the TSR, the analysts may provide analysis of 2 or 3 more options around emphasis assignment after completion of the TSR report. The results of this analysis will be sent to the District Manager for use during the landscape unit planning process.

If you have any questions regarding the above procedures please contact Cassandra Mann, Manager Analysis Section, Timber Supply Branch, Victoria at (250) 356-5953 or Cassandra.Mann@gems7.gov.bc.ca.